

# DIY

*Worthwhile projects you can build on your own*



## 4:1 current balun

In another newsletter article (*UVARC Shack*, [June 2017](#), p. 2 - 3), we discussed the fundamentals of *baluns*, their different types, and how they work, without going into a lot of detail. This time, we'll show you how to make a *4:1 current balun*, which will not only match a 200-ohm antenna system with a 50-ohm source, but eliminate *common-mode current*, which can waste a lot of energy and introduce shack RF.

We also showed in the last issue (*UVARC Shack*, [December 2019](#), p. 16 -17) how to use a 4:1 balun to bring a 600-ohm ladder line within reach of a 3.0:1 autotuner (600 ohms ÷ 4 = 150 ohms, and 150 ohms is 50 ohms x 3, so that a tuner that can handle a 3.0:1 SWR can tune this system). Some of the material for this article was taken from [Charlie MØPZT](#).

### Parts list

- |  |  |
|--|--|
| Two toroidal <a href="#">FT240-31</a> ferrite cores  | Four M3-0.5 mm x 14 mm machine screws          |
| 30 feet of <a href="#">18 AWG zip wire</a>           | Four M3-0.5 mm hex nuts                        |
| One Awclub <a href="#">JP65 electrical enclosure</a> | Four M3 split washers                          |
| One <a href="#">SO-239 solder bulkhead</a>           | One #4 x 18 AWG ring terminal                  |
| Two 1" #8-32 zinc plated machines screws             | Two <a href="#">#8 x 18 AWG ring terminals</a> |
| Two #8-32 wing nuts                                  | Two #8 split washers                           |
| Two #8 flat washers                                  | Four 11" zip ties, small piece of heat shrink  |

### Construction

Let's start with the most difficult part first, the winding of the toroids. Wind the two toroids identically, but with the red wire on the left for one, and the red wire on the right for the other, as in the photo. For each toroid, **tightly** wrap six turns of the wire pair on one side, then



cross the pair over then under the diameter to wrap six more turns in the same direction, but on the other side of the pair. Zip-tie the two ends to secure them in place, leaving about six inches of wire pair on each end to work with, then strip all eight wire ends. (For reference, the *transceiver end* is on the left side in this photo, and the *antenna end* is on the right.)



# DIY, continued

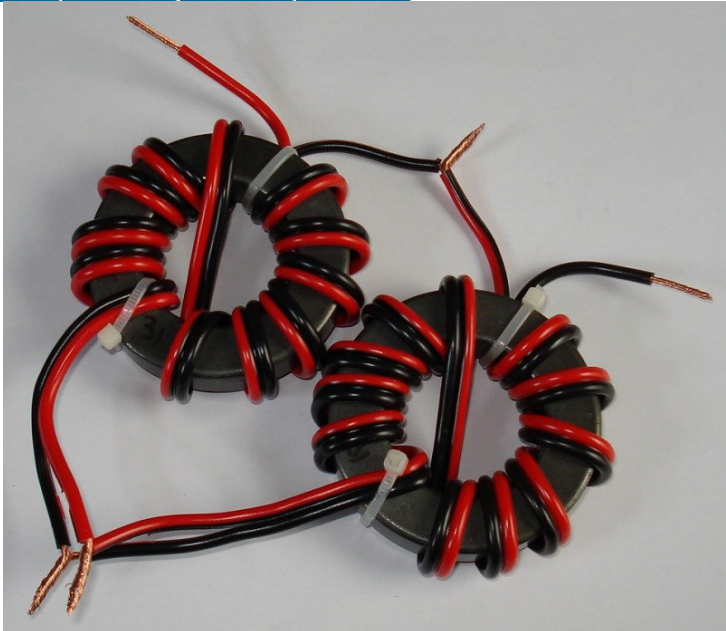
## Ladder line



At the transceiver end, twist the two red wires together, and the two black wires together. At the antenna end, twist the black wire of the toroid with the red on the right onto the red wire of the other toroid, solder them together, and cover the junction with heat shrink tubing.

### Install the enclosure

Drill a  $\frac{1}{2}$ " hole on one end of the enclosure. Place the solder end of the SO-239 bulkhead into the  $\frac{1}{2}$ " hole on the outside of the enclosure, and using the four mounting holes of the bulkhead as a template, drill a  $\frac{1}{8}$ " hole for each mounting hole. At the transceiver end of your wired toroids, solder the red pair to the center conductor of the bulkhead. Solder the black pair to the



#4 x 18 AWG ring terminal. Solder the black pair to the #4 x 18 AWG ring terminal. Solder the red wire of the antenna end to a #8 x 18 AWG ring terminal, and the black wire to another. Assemble the bulkhead onto the enclosure using the M3-0.5 mm hardware, with the ring terminal attached to one of the screws.

Drill two  $\frac{3}{16}$ " holes on convenient sides (opposite or top, for example) of the enclosure, and install the #8 machine screws and hardware (wing nuts on the enclosure exterior), with a wired and soldered #8 ring terminal attached to each. Zip-tie the two toroids together, one on top of the other. Install the cover on the enclosure, and the balun construction is complete.

### In the end

Building your own 4:1 current balun is not difficult, but does require the correct materials (toroids) and some patience. Because of the zip wire and its insulation, this balun should easily handle 200 watts. As for performance, it should be workable on 160, 80, 40, 20, and 15 meters (but not so well on 12 and 10 meters) if you apply it to a fan dipole, G5RV, or doublet antenna, even with a tuner. The enclosure is made for all-weather outdoor installation, but because of the side bolts and SO-239 holes, you'll need to take extra steps to ensure the balun is weatherproof, if you want to leave it out in the rain.

If, after all this, you still want to simply purchase a 4:1 current balun, I recommend the \$84 [BalunDesigns 411TW](http://BalunDesigns.com/411TW), which meets my personal standards of RF specification and construction quality for 160 meters through 6 meters up to 5 kW. Meanwhile, if you're inclined to build stuff like I am, this balun is a reliable, yet inexpensive solution.

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